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Medical Group

Archives of Community Medicine and Public Health

ISSN: 2455-5479 DOI CC By

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Dates: Received: 29 May, 2017; **Accepted:** 26 June, 2017; **Published:** 28 June, 2017

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Keywords: Under five mortality; Millennium development goals; Sustainable development goals; India

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Review Article

Under-Five Mortality in India: A Muddled Trip through Millennium Development Goal - 4

Abstract

The Millennium Development Goal-4 (MDG-4) had a target of reducing the under-five mortality rate (U5MR) by two-thirds, between 1990 and 2015. When compared to 1990 levels, 17,000 fewer children died each day in 2015. In 2012, UNICEF found that, globally, children born in the poorest 20% of households had only half the chance of surviving to their fifth birthday as children born in the richest 20% of households. Many countries, including India could not attain the MDG-4. The Sustainable Development Goals (SDGs) seeks to build on the Millennium Development Goals (MDGs) and "complete what these did not achieve, "particularly in reaching the most vulnerable. The SDGs are committed to the full realization of all the MDGs, including the off-track MDGs, by providing focused and scaled-up assistance to least developed countries and other countries in special situations, in line with relevant support programs. MDG-4 failed to achieve its single target of reducing child mortality. This review attempts to provide an insight into the under-five mortality in India. Various internet based popular search engines were used to explore data from literature, which includes PubMed, PubMed Central, Google Scholar, Medknow, and Science Direct. Search was made using the key-word combinations "under five mortality" and "millennium development goals" were used. The search was limited to reviews; meta-analyses and assorted reports were retrieved and evaluated. A total of 25 publications were evaluated for this review article.

Introduction

The under-five mortality rate is a key indicator of child well-being, including health and nutrition status. It is also a key indicator of the coverage of child survival interventions and, more broadly, of social and economic development [1]. Under-five mortality rates fell rapidly from 2000 to 2015, declining by 44 per cent globally, leading to a global under-five mortality rate of 43 per 1,000 live births [1]. Even then about six million children under the age of 5 still died before their fifth birthday in 2015. The neonatal mortality rate declined from 31 deaths per 1,000 live births in 2000 to 19 deaths per 1,000 live births in 2015. Neonatal deaths represent a larger share (45 per cent) of all under-five deaths as the progress in the rate of survival among children aged 1 to 59 months outpaced advances in reducing neonatal mortality [1].

The Millennium Development Goal-4 (MDG-4) had a target of reducing the under-five mortality rate (U5MR) by two-thirds, between 1990 and 2015. When compared to 1990 levels, 17,000 fewer children died each day in 2015. Since 2000, measles vaccines have averted nearly 15.6 million deaths and 3 out of 4 births were assisted by skilled health-care personnel [2]. Despite improved global progress, a substantial proportion of under-five deaths were in sub-Saharan Africa and Southern Asia, accounting for as much as four out of every five under-five child deaths in these regions. Children belonging to poor families and of illiterate mothers have more chances of dying before the age of five when compared to those from wealthier families. In 2012, UNICEF found that, globally, children born in the poorest 20% of households had only half the chance of surviving to their fifth birthday as children born in the richest 20% of households [3].

The Sustainable Development Goals (SDGs) seeks to build on the Millennium Development Goals (MDGs) and "complete what these did not achieve, "particularly in reaching the most vulnerable. The SDGs are committed to the full realization of all the MDGs, including the off-track MDGs, by providing focused and scaled-up assistance to least developed countries and other countries in special situations, in line with relevant support programs. MDG-4 failed to achieve its single target of reducing child mortality. Goal-3 of SDGs aims to ensure healthy lives and promote well-being for all at all ages. Target 3.2 of SDG-3 is to end preventable deaths of newborn and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births,

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by 2030 [4]. About half of under-five deaths occur in only five countries: India, Nigeria, Pakistan, Democratic Republic of the Congo and China. Around two-thirds of neonatal deaths occur in just 10 countries, with India accounting for more than a quarter and Nigeria for about a tenth [1].

South Asia has made faster progress than any other region in reducing child deaths and has halved its under-five deaths from 4.7 million in 1990 to 2.1 million in 2012, the total share of global under-five mortality being 6.6 million [5]. With 1.4 million children dying before reaching their fifth birthday, India had the highest child mortality rate worldwide (56/1000 LB) and compared poorly with even its neighboring countries, Bangladesh (41/1000 LB) or Nepal (42/1000 LB), both having already achieved their respective MDGs-4, unlike India. Public Health is one of the best reflections of human development in a country. India is one of those countries where the spending on public health in proportion to percentage of GDP is one of the lowest in the world. The important indicators of health in a country are: (1) Infant Mortality Rate (2) Maternal Mortality Rate (3) Life Expectancy at Birth. India is lagging behind on targets for reducing child and maternal mortality. Child mortality rate was 49/1000 live births (LB) in 2013, Infant mortality rate was 40/1000 LB in 2013 [6]. Primary health care (PHC) is equally valid for all countries from the most to the least developed, although it takes varying forms in each of them. The concept of PHC has been accepted by all countries as the key to the attainment of Health for All by 2000 AD.

Methods of Literature Search

The materials for this review were obtained from an extensive search using Medical Subject Headings of electronic databases which included PubMed, PubMed Central, Google Scholar, Medknow, Science Direct and Textbooks were searched until 2016. Literature on the Under-five Mortality in India through Millennium Development Goal was retrieved. The key words used for the literature search included "Under five mortality" and "Millennium development goals". The search was limited to reviews; meta-analyses and assorted reports were retrieved and evaluated from 2005 to 2016 in English. A total of 31 articles were identified. After examining the titles and abstracts, this number was finally reduced to 25 articles. A summary of under-five mortality rate of different states of India is depicted in figure 1.

Covariates of Infant and under-five mortality

According to Mosley and Chen, 14 intermediate variables directly influence the risk of morbidity and mortality grouped into five factors: maternal factors, environmental contamination with infectious agents, nutrient deficiency, injury and personal illness [7]. Maternal factors include age of mother at the time of birth, birth order, birth interval, son preference, maternal malnutrition (anaemia) and low birth weight; environmental factors include water supply, toilet facilities and use of biomass fuels for cooking; programmatic factors include TT Immunization, full consumption of iron folic acid tablets, delivery in medical facility and delivery by TBA; socioeconomic and demographic factors include income, urban/rural residence and maternal education.

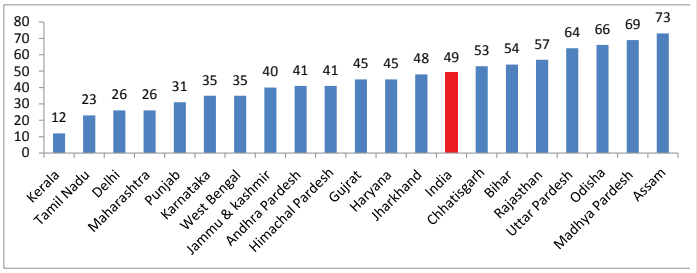

Figure 1: Under-five mortality rate of different states of India in 2013.
Source: Millennium Development Goals India Country Report 2015- India. Available at: http://mospi.nic.in/sites/default/files/publication_reports/mdg_2july15_1.pdf.

Trends in under-five mortality rate

Globally, the five leading causes of deaths among children under five include pneumonia (18%); pre-term birth (14%); diarrhoea (11%); intrapartum-related complications (9%) and malaria (7%). The number of deaths among children under five worldwide has decreased from 12.4 million in 1990 to 7.6 million in 2010, a reduction of nearly 40% in spite of an increase in the number of births. As deaths in the 1- 59 months age group decline, deaths in the first 28 days (neonatal deaths) represent a growing proportion of all under-five deaths. At least two-thirds of all child deaths are preventable, with pneumonia and diarrhoea as the largest killers of children after the newborn period followed by malnutrition.

Black et al. [8], found maternal and child under nutrition to be the underlying causeof 3·5 million deaths, 35% of the disease burden inchildren younger than 5 years and 11% of total global DALYs. About 80% of the world's undernourished children live in just 20 countries. The first 28 days-the neonatal period represents the most crucial period of a child's survival. Globally 2.6 million still-births (≥28 weeks or ≥1000 g) occur every year, of which more than half (1.45 million) occur during the antepartum period [9]. These stillbirths were not counted in the MDGs and progress has been substantially slower than even that for reductions in newborn mortality.The risk of intrapartum stillbirth is 24 times higher for an African woman than for a woman in a high-income country. Yet these deaths are largely preventable.

Where are the gaps?

Concern has been raised that neonatal death rates in India are not falling at a fast pace [10]. The million death study in India suggested that almost half of India's neonatal deaths are caused by birth asphyxia & birth trauma, sepsis, pneumonia and tetanus – conditions that can be avoided by increases in delivery care and postnatal care [11]. Antibiotic treatment of bacterial pneumonia is highly efficacious, but may be compromised by increasing resistance of bacteria to inexpensive antibiotics. There is no available treatment or vaccines for important viral causes of lower respiratory illness, such as Respiratory Syncytial Virus. For rotavirus diarrhea, the most important cause of severe childhood diarrhea globally, the vaccine provides only about 50% protection in LMICs. ORS and zinc are effective treatments for diarrhoea, but coverage remains too low [12]. Neonatal mortality is often not addressed

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by traditional public health and maternal and child health programs. Poor health system capacity for newborn care results in three important delays in seeking and receiving appropriate care [13].

Money remains a significant barrier to seeking care; two-thirds of women identified getting money for treatment as a problem. The challenge is not technical (effective interventions exist), but social. The odds of a child surviving the first month of life are grossly unequal, even within one country, and are affected by wealth, education, caste, and access to health care. Large gains are achievable when interventions reach people who are in need. Community health workers are not recruited in sufficient numbers and they need training, supervision and support in management of sick children. Even where health care services are available, the cost of seeking care may delay or prevent poor households from accessing them. The cost of seeking care may be thought of as comprising direct costs (such as user fees), indirect costs (such as costs for transportation) and opportunity costs (such as lost wages). The opportunity cost of seeking health care is relatively higher for poorer than wealthier households as taking care of sick children often diverts the labor and time of the poor away from income-generating activities, thereby reducing household income [14].

Since 2005, when all WHO member states made the commitment to universal health coverage, many advances have been made in the provision of health services and in financial risk protection. This is illustrated by progress towards the health-related Millennium Development Goals (MDGs), and in the widespread fall in cash payments made for using health services. Despite this progress, the coverage of health services and financial risk protection currently fall far short of universal coverage [15].

A cohort study conducted to find out the risk factors of perinatal mortality in Ludhiana, Punjab, India, reported the perinatal mortality rate to be as high as 51/1000 births [16] and still birth rate to be 23.1/1000 births [17]. Mother's age <20 years, illiteracy, lack of regular paid employment outside the home, nuclear families, residence in urban slums and poverty were observed to be important socio-economic determinants of perinatal mortality. Multigravidity, maternal anaemia, low birth weight, gestational age <37 weeks and delivery by untrained dais were identified as significant risk factors for perinatal mortality. Spacing <3 years and lack of ante-natal care including tetanus and anaemia prophylaxis also carried a higher risk of perinatal mortality.

Vital registration data

Mortality data are important indicators of population health and are crucial for setting priorities for health interventions and research. Information regarding causes of neonatal death, particularly in the first week of life when three-quarters of neonatal deaths occur, is fundamental for developing public health strategies. Worldwide, 95% of under-five deaths occur in countries without reliable vital registration data, and most information comes from District health services. A reliable assessment of disease-specific mortality rates is not yet possible in many parts of India, either because the underlying cause of the terminal illness was never known or because the relevant information was not recorded. Many low- and middle-income countries lack a systematic approach for reviewing the causes and factors linked to maternal and perinatal deaths and "near-miss events" occurring in facilities and in the community. The large number of stillbirths and neonatal deaths, particularly in comparison to maternal deaths, presents a challenge to already weak health information systems that are not equipped to capture, let alone review, the quality of services provided to each baby who died.

What interventions are available

A small set of evidence-based and cost-effective interventions focusing on the mother-child dyad can prevent a major part (up to 72%) of neonatal deaths [17]. Over three-fifths of all 2.3 male child deaths in India in 2005 were caused by five conditions: pneumonia, prematurity & low birthweight, diarrhoeal diseases, neonatal infections and birth asphyxia & birth trauma [18]. India is home to 40% of the world's malnourished children. Every year, 2 million children die in India, accounting for one in five child deaths in the world. More than half of these deaths could be prevented if children were well nourished [19]. Health education and motivation of mothers were evidenced to lead to a significant improvement in the nutritional status of malnourished children [20]. Each of the major causes of neonatal deaths can be prevented or treated with known, highly effective and widely practicable interventions such as improvements in prenatal care, intrapartum care (skilled attendance, emergency obstetric care and simple immediate newborn care), postnatal family-community care (preventive post-natal care, oral antibiotics management of pneumonia) [21], and tetanus toxoid immunization [22].

In a field trial in Gadricholli, about one-third of the reduction in neonatal mortality was found to be due to sepsis management, a further third to supportive care of neonates with a low birth weight, and around one-fifth to asphyxia management [23]. From a health system perspective, IMNCI is cost effective strategy for child survival in India, with a 90% probability to be cost effective at a willingness to pay threshold of INR 2300 (USD 51) [24]. However, due to lack of human and financial resources, implementation of IMCI has been slow in many countries. Vaccine-preventable diseases contribute to around 25% of under-5 mortality. Maintenance of room warmth, immediate drying and wrapping, prompt recognition of hypothermia, and re-warming of hypothermic infants averts up to 40% of neonatal deaths. Breastfeeding Immediate (within 1 hour after birth) and exclusive (no prelacteal feeds or other fluids/food) breastfeeding averts nearly 10% of all neonatal deaths. Skin-to-skin contact between mothers and newborns, by Kangaroo Mother Care (KMC) maintains warmth, encourages nursing, discourages over-handling, and enhances maternal recognition of newborn problems, reducing infection rate by about half.

The most important strategy to reduce stillbirths is improved care at birth, early recognition of danger signs and training skilled birth attendants for emergency resuscitation

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and essential new born care. Other interventions proven to reduce stillbirths are: family planning, identification and treatment of hypertension, diabetes and STDs, particularly syphilis, by inducing post-term pregnancies (at >41 weeks) and by conducting newborn resuscitation. Scaling up of effective care, especially quality childbirth services could halve stillbirth rates by 2020. As a complement to a country's civil and vital registration system, maternal and perinatal mortality audits can provide essential evidence to guide programmatic changes, leading to better quality of care. Some countries are making an effort towards registering every birth and death and promoting review of select stillbirth and neonatal death cases in order to improve the quality of intrapartum care.

Newborn and child health interventions started in India to meet SDGs

- Facility based newborn care (FBNC) is one of the key components under the National Health Mission to improve the status of newborn health in the country. A continuum of newborn care has been established with the launch of home based and facility based newborn care components ensuring that every new born receives essential care right from the time of birth and first 48 hours at the health facility and then at home during the first 42 days of life. Newborns identified as sick or preterm/low birth weight soon after birth or during home visit are referred to special newborn care facilities for further management and long term follow up after discharge.

- Newborn Care Corners (NBCCs) are established at delivery points to provide essential newborn care at birth, while Special Newborn Care Units (SNCUs) and Newborn Stabilization Units (NBSUs) provide care for sick newborns.

- Janani Shishu Suraksha Karyakram (JSSK): Complete elimination of out of pocket expenses with provision of free transport, drugs, diagnostics and diet to all sick newborns and infants is being ensuredin the country.

- Rashrtiya Bal Swasthya Karyakram (RBSK): This initiative was launched in February 2013 for Early Child Health Screening and Early Intervention Services through early detection and management of 4 'D's i.e Defects at birth, Diseases, Deficiencies, Development delays including disability are to cover 30 selected health conditions for early detection, management and free treatment.

- Navjaat Shishu Suraksha Karyakram (NSSK): Auxillary Nurse Midwives are trained in essential newborn care and resuscitation.

- Up scaling of Kangaroo Mother Care (KMC) in health facility: Up to half a million newborns could be saved each year if kangaroo care was promoted everywhere.

- Empowering frontline health service providers: The ANMs are now empowered to give a pre-referral dose of antenatal corticosteroid (Injection Dexamethasone) in pregnant women going into preterm labour and pre-referral dose of Injection Gentamicin and Syrup Amoxicillin to newborns for the management of sepsis in young infants (up to 2 months of age).

- India Newborn Action Plan (INAP): On 18th Sept 2014, India Newborn Action Plan was launched inresponse to Global Newborn Action Plan. INAP lays out a vision and a plan for India to end preventable newborn deaths, accelerate progress, and scale up high-impact yet cost-effective interventions. It is expected to attain "Single Digit Neonatal Mortality Rate by 2030" and "Single Digit Still Birth Rate by 2030".

- Home based newborn care: Keeping the spirit of continuum of care facility based care is linked to home based newborn care which provides opportunity for early diagnosis of danger signs, prompt referral to an appropriate health facility with provision for newborn care facility, saves lives.

- The Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA): To identify and follow up on high risk pregnancies in order to reduce Maternal Mortality Rate (MMR) and Infant Mortality Rate (IMR)

- Mother's Absolute Affection: A nationwide program to bring undiluted focus on promotion of breastfeeding.

- Mission Indradhanush: Aims to immunize all children under two years against seven vaccine preventable diseases like diphtheria, whooping cough, tetanus, poliomyelitis, tuberculosis, measles and hepatitis B.

- Integrated Management of Neonatal and Childhood Illnesses (IMNCI): Medical officers and staff nurses would be trained in facility based IMNCI to provide care to sick children and newborns at CHCs/FRUs.

- Infant and young child feeding (IYCF): Promotion of optimal IYCF practices and management of lactational failure/breast related conditions such as Home Based New Born Care visitations, Village Health Nutrition Day (VHND), Outreach sessions for Routine Immunisation (RI), RI sessions at facilities, management of newborn and childhood illnesses at community level.

- Nutritional rehabilitation centers (NRC): Nutritional Rehabilitation Centers are facility based units providing medical and nutritional therapy to children with severe acute malnourished under 5 years of age with medical complications.

- Vitamin-A Supplementation in under-five children

- Child death review (CDR): CDR is being implemented across the country for the corrective action for implementation of child health interventions as per detailed review of causes of death and reason for delay if any.

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- Reduction in morbidity and mortality due to acute respiratory infections (ARI) and diarrheal diseases: Introduction of Rotavirus vaccine and Haemophyllus Influenza vaccine in the Universal Immunisation Programme. Procurement of ORS and Zinc and its supplies at each public health facility and ASHA. Intensified Diarrhoea Control Fortnight (IDCF) was implemented this year from 28th July to 8th August 2014 all over the country with the ultimate aim of 'zero child deaths due to childhood diarrhea.' For children with non-severe pneumonia the ARI control program recommends oral Cotrimoxazole as the first line drug. Provisions have been made for procuring required equipment's such as Nebulisers, Pulse Oxymeters and relevant antibiotics at each level.

10 Key strategies to Meet the Challenges

1) Preconception and adolescent care interventions, 2) Training of care providers, 3) Audits and feedback mechanisms, 4) Paying health workers for performance, 5) Safe childbirth checklist, 6) Information systems (mobiles), 7) Social support during pregnancy and labour, 8) Breastfeeding support interventions, 9) Reduction of financial barriers and 10) Community outreach programs.

Evidence-based and cost-effective interventions focusing on the mother-child dyad can prevent a major part (up to 72%) of neonatal deaths. Key interventions for newborns include immediate drying and stimulation at birth; immediate and exclusive breastfeeding; chlorhexidine umbilical cord care, kangaroo mother care [25]. Research may be carried out on the following domains: Evaluating the impact and safety of KMC and other interventions at the community level, early detection of high-risk women, improved and simplified intrapartum monitoring, evaluation of appropriate oral antibiotics for treatment of neonatal sepsis, role of perinatal audits in improving quality of care during labour and childbirth, to discover causal pathways of preterm labour, new tocolytics to delay preterm birth, stable surfactant with easier mode of delivery, and to discover more accurate and affordable ways to detect fetal distress.

Conclusion

Integrated and synergistic efforts of the public, private and civil society to improve outcomes in nutrition, water and sanitation, health, education and other sectors that impact outcomes for women and children, can improve child survival. Improving maternal nutrition and provision of ante-natal, intra-natal and post-natal care by trained personnel to all pregnant women are areas where priority action is required, directed particularly at the most vulnerable and "at risk" poor, the slum-dwellers and the marginalized is required.

Universal coverage of cost-effective interventions at the community through increased health workforce is the need of the hour, which appears feasible by the National Urban Health Mission. Through investments in domestic production, as well as research and development, the private sector wields enormous influence over the availability, affordability and quality of life-saving commodities and medicines. Mobile applications can be made use of for proper monitoring and supervision.

To increase political prioritization of notification and review of stillbirths and neonatal deaths, the Every Newborn Action Plan includes a milestone for developing perinatal mortality audit guidelines. These guidelines will help clarify who is responsible for recording and reviewing stillbirths and neonatal deaths and how to use the information to improve health worker and health system performance.

Acknowledgement

We are grateful to Dr. Reeta Rasaily, (Scientist – E), Division of Reproductive Health and Nutrition for supporting the ICMR project IRIS ID No. 2011-11380 from which this review article was derived.

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